What is the relationship between the intake of animal protein products and body weight?

Conclusion

Insufficient evidence is available to link animal protein intake and body weight.

Grade: Limited

Overall strength of the available supporting evidence: Strong; Moderate; Limited; Expert Opinion Only; Grade not assignable For additional information regarding how to interpret grades, click here.

Evidence Summary Overview

Three articles (Mahon, 2007; Wagemakers, 2009; Xu, 2007) published since 2000 were identified that examined the relationship between animal protein products and body weight. Inconsistent findings were reported in a cohort of British adults (Wagemakers, 2009) on whether meat intake was associated with body mass index (BMI) and waist circumference (WC) who were studied between 1989 and 1999. Red and processed meat consumed in 1999 was significantly associated with increased BMI in women only. In a cross-sectional study in China (Xu, 2007), red meat consumption was associated with excess body weight. In the only US study found (Mahon, 2007), overweight postmenopausal women were successful in weight loss with either a meat-containing or vegetarian protein intervention. Thus, existing research is sparse and finds little link between meat intake and body weight, and meat-containing diets work as well as calorie-controlled vegetarian diets in enhancing weight loss in intervention studies.

Evidence Summary Paragraphs

Mahon et al, 2007 (positive quality) used a randomized controlled trial (RCT) to assess the effects of dietary protein intake on energy restriction-induced changes in body mass and body composition. Participants were 54 postmenopausal women aged 58±2 years with a BMI of 29.6±0.8kg/m^2. Participants were assigned to one of four groups: Three groups ate energy-restricted (ER) (1,000kcal per day) lacto-ovo vegetarian basal diet plus 250kcal per day of either beef (BEEF), chicken (CHICKEN) or carbohydrate and fat foods (CARB), while a control group (CON) ate their habitual diets. Basal diet was distributed as a five-day fixed menu that consisted of three meals and two snacks equaling 1,000kcals. BEEF was provided with 250kcal per day of cooked beef; CHICKEN was given 250kcal per day of cooked chicken breast and 10 g of butter and the CARB group was provided with shortbread cookies and sugar-coated chocolates. Body composition assessment was taken before and after the nine-week intervention for estimation of percent body fat, fat mass (FM) and fat-free mass (FFM) using DEXA. Energy intake was lower in the ER groups compared to CON (BEEF=1,114±155kcal per day, CHO: PRO: FAT, 46:24:30% of energy intake; CHICKEN=1,098±203kcal per day, 51:25:24; CARB=1,158±341kcal per day, 59:17:24; CON=1,570±633kcal per day, 47:20:33), but did not differ among ER groups. The percent energy intake from protein was lower in CARB compared to BEEF, CHICKEN and CON. Total dietary fiber intake was not different across time or among groups. Compared to CON, the ER groups decreased body mass, BMI, FM, percent body fat and FFM. These responses were not different among the ER groups, except for a greater change in body mass (CHICKEN -7.9±2.6kg[a]; BEEF

-6.6±2.7kg^{ab}; CARB -5.6±1.8kg^{b}; CON -1.2±1.2kg^{c}; values with different superscript differ, P<0.05) and BMI (CHICKEN -3.0±1.2kg/m^{2a}; BEEF -2.5±1.1kg/m^{2ab}; CARB -2.1±0.7kg/m^{2b}; CON -0.3±0.5kg/m^{2c}; P<0.05) for CHICKEN vs. CARB. The authors concluded that overweight postmenopausal women can achieve significant weight loss and comparable short-term improvements in body composition by consuming either a moderate-protein (25% of energy intake) poultry- or beef-containing diet or a lacto-ovo vegetarian protein (17% of energy intake) diet.

Wagemakers et al, 2009 (neutral quality) investigated whether a high consumption of red or processed meat is associated with increased risk of coronary heart disease (CHD) in a cohort of British adults (N=1,152, 55% female, age 43 at baseline) followed from 1989 to 1999. Food intake was self-recorded using five-day diaries in 1989 and 1999. Meat consumption was estimated by adding individual meat portions to the meat fractions of composite dishes. Red meat, processed meat, and combined red and processed meat intake were considered. Height, weight and waist circumference (WC) were measured by study personnel at both time points. Body weight increased more than 5 kg for both men and women between 1989 and 1999. No significant differences were observed in BMI or WC in 1999 for thirds of red meat or processed meat consumed in 1989 for men or women. The highest male consumers of red and processed meat combined in 1989 had significantly greater BMI (P=0.027) and WC (P=0.009). Using 1999 dietary data, WC of men only was significantly greater in the highest third of red meat consumption (P=0.013). The highest consumers of processed meat in 1999 had significantly increased WC for men (P=0.009) and women (P=0.001) and BMI for women only (P=0.001). The highest consumers of red and processed meat combined in 1999 had higher WC for men (P<0.001) and women (<0.001) and BMI for women only (P<0.001). A 10 g increase in red meat consumption in 1989 was associated with a 0.3 cm increase in WC of men (P=0.035) and women (P=0.048) in 1999. A similar association was found for consumption of processed meat. Red and processed meat consumed in 1999 was significantly associated with increased BMI in women only. The authors concluded that significant positive associations were observed between meat consumption measured 10 years earlier or synchronously and BMI and WC.

Xu et al, 2007 (positive quality), a cross-sectional study, examined the association of red meat and vegetable consumption with excess body weight. Participants were 23,316 adults (51% female, age 35-45 years) from a large-scale population-based cross sectional study from Nanjing municipality in China. Diet was assessed through household interviews with a structured questionnaire. Red meat ("mammals' meat") and white meat (seafood and poultry) were included in the interview, but only red meat was considered in the analyses. Height and weight were measured by study personnel. Seventy-seven percent of participants consumed red meat more than six times per week. The prevalence of excess body weight was significantly higher among participants with high and moderate red meat intake than those in the lower level (OR=1.19; 95% CI: 1.09, 1.30 and OR=1.11, 95% CI: 1.03, 1.20) for subjects with high and moderate consumption of red meat, respectively, compared to low consumption after adjusting for multiple confounders. The authors concluded that consumption of red meat was significantly associated with excess body weight.

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Author, Year, Study Design, Class, Rating	Participants	Description of Study Methodology	Outcomes

Mahon AK, Flynn MG et al, 2007 Study Design: Randomized controlled study. Class: A Rating:	Initial N: 57 postmenopausal women; Final N: 54. Age: 58±2 years. BMI: 29.6±0.8kg/m^2. Caucasian. Location: United States.	Participants were assigned to one of four groups: Three groups ate energy-restricted (ER) (1,000kcal per day) lacto-ovo vegetarian basal diet plus 250kcal per day of either beef (BEEF), chicken (CHICKEN) or CHO/fat foods (CARB), while a control group (CON) ate their habitual diets. Basal diet was distributed as a five-day fixed menu that consisted of three meals and two snacks equaling 1,000kcals. BEEF was provided with 250kcal per day of cooked beef. CHICKEN was given 250kcal per day of cooked chicken breast and 10g butter. CARB group was provided with shortbread cookies and sugar-coated chocolates. Length of treatment: 11 weeks (nine-week intervention and two-week weight maintenance period). Body composition assessment taken pre- and post-intervention for estimation of percent body fat, fat mass (FM) and fat-free mass (FFM) using DEXA.	Energy intake was lower in the ER groups compared to CON (BEEF=1,114±155kcal per day, CHO: PRO: FAT, 46:24:30% of energy intake; CHICKEN=1,098±203kcal per day, 51:25:24; CARB=1,158±341kcal per day, 59: 17:24; CON=1,570±633kcal per day, 47: 20:33), but did not differ among ER groups. The percent energy intake from protein was lower in CARB compared to BEEF, CHICKEN and CON. Total dietary fiber intake was not different across time or among groups. Compared to CON, the ER groups ↓ body mass, BMI, FM, percent body fat and FFM. These responses were not different among the ER groups, except for a greater Δ in body mass (CHICKEN -7.9±2.6kg^a; BEEF -6.6±2.7kg^{ab}; CARB -5.6±1.8kg^b; CON -1.2±1.2kg^c; values with different superscript differ, P<0.05) and BMI (CHICKEN -3.0±1.2kg/m^{2a}; BEEF -2.5±1.1kg/m^{2ab}; CARB -2.1±0.7kg/m^{2b}; CON -0.3±0.5kg/m^{2c}; P<0.05) for CHICKEN vs. CARB.
Wagemakers et al 2009 Study Design: Cohort Class: B Rating:	N=1,152 (55% women). Age: 43 years at baseline. Medical Research Council National Survey of Health and Development. Location: United Kingdom.	Food intake was self-recorded using five-day diaries at two time periods: 1989 and 1999 (included in analysis if at least three days were recorded). Meat consumption was estimated by adding individual meat portions to the meat fractions of composite dishes. Red meat (beef, lamb, pork, veal and mutton) and processed meat (ham, bacon, sausages, processed meat cuts and processed minced meat). Height, weight and waist circumference (WC) were measured by study personnel in 1989 and 1999.	Body weight ↑ more than 5kg for both men and women between 1989 and 1999. *1989 dietary intake:* Red meat and processed meat; NS differences were observed in BMI or WC in 1999 for thirds of red meat or processed meat consumption in 1989 for men or women. Red and processed meat combined; the highest male consumers of these meats in 1989 had significantly greater BMI (P=0.027) and WC (P=0.009). *1999 dietary intake:* Red meat; WC of men only was significantly > in the highest third of red meat consumption (P=0.013). NS difference in BMI for men or women.

			Processed meat; the highest consumers of processed meat had significantly ↑ WC for men (P=0.009) and women (P=0.001) and BMI for women only (P=0.001). Red and processed meat combined; the highest consumers of red and processed meat combined had higher WC for men (P<0.001) and women (P<0.001) and BMI for women only (P<0.001). A 10g ↑ in red meat consumption in 1989 was associated with a 0.3cm ↑ in WC of men (P=0.035) and women (P=0.048) in 1999. A similar association was found for consumption of processed meat. Red and processed meat consumed in 1999 was significantly associated with ↑ BMI in women only.
Xu F, Yin XM et al, 2007 Study Design: Cross-sectional study Class: D Rating:	N=23,316 (51% female). Age: 35-45 years. Location: China.	Diet assessed by household interviews with structured questionnaire. Red meat ("mammals' meat") and white meat (seafood and poultry) included in interview, but only red meat considered in analyses.	77% of participants consumed red meat more than six times per week. The prevalence of excess body weight was significantly higher among participants with high and moderate red meat intake than those in the lower level (OR=1.19; 95% CI: 1.09, 1.30 and OR=1.11, 95% CI: 1.03, 1.20) for subjects with high and moderate consumption of red meat, respectively, compared to low consumption after adjusting for multiple confounders.

Research Design and Implementation Rating Summary
For a summary of the Research Design and Implementation Rating results, click here.

Worksheets

Mahon AK, Flynn MG, Stewart LK, McFarlin BK, Iglay HB, Mattes RD, Lyle RM, Considine RV, Campbell WW. Protein intake during energy restriction: effects on body composition and markers of metabolic and cardiovascular health in postmenopausal women. *J Am Coll Nutr*. 2007 Apr; 26 (2): 182-189.

Wagemakers JJMF, Prynne CJ, Stephen AM, Wadsworth MFJ. Consumption of red or processed meat does not predict risk factors for coronary heart disease; results from a cohort of British adults in 1989 and 1999. Eur J Clin Nutr 2009;63:303-311.

Xu F, Yin XM, Tong SL. Association between excess bodyweight and intake of red meat and vegetables among urban and rural adult Chinese in Nanjing, China. Asia *Pac J Public Health.* 2007; 19(3): 3-9.